

# Description

## PELVIS LEVEL

### BACKGROUND OF INVENTION

[0001] The present invention relates to surgery. More specifically, the invention relates to hip-replacement surgery. Such surgery is frequently performed as a treatment for arthritis of the hip. Sometimes, the hip ball can, after the operation, slip out of the hip socket. Such an occurrence is technically and medically referred to as a dislocation. A common cause of such dislocation is improper positioning of the acetabular component (hip socket) in the patient's pelvic bone. There are generally accepted angles for placement of the acetabular component that an orthopedic surgeon attempts to attain while performing the surgery. To do so, the surgeon must know or determine the orientation of the patient's pelvic bone. Herein lies the problem. The patient is covered with sterile surgical drapes, and only a small portion of the bone is visible. The patient may be leaning forward or backward, and there is no accurate method to assess his or her exact po-

sition or orientation. The present invention provides a solution to this problem.

## **SUMMARY OF INVENTION**

[0002] In general, the present invention provides instrumentation and method for determining the orientation of the pelvic bone during hip-replacement surgery.

[0003] The instrumentation comprises a pelvis frame and a pelvis level.

[0004] The pelvis frame comprises (a) a first rigid elongated member; (b) a second rigid elongated member mounted on the first rigid member in a perpendicular relationship thereto; (c) first and second pads attached to the first rigid elongated member in a perpendicular configuration; (d) a third pad attached to the second rigid elongated member in a perpendicular configuration; and (e) means for varying the position of the first, second, and third pads, and for fixating said position as required, for effecting orientation-determining contact of the first, second, and third pads with the pelvic bone of a patient undergoing hip-replacement surgery. The first, second, and third pads are contoured to conform to portions of the pelvic bone which said pads contact.

[0005] The pelvis level comprises a housing which includes first

and second parallel straight-line openings extending therethrough, for insertion therein of first and second wires used to effect temporary connection of the housing to the pelvic bone of a patient undergoing hip-replacement surgery. The pelvis level further comprises a level, disposed in the housing under a transparent cover, for determination of a level position of the housing.

[0006] The method comprises (a) providing a pelvis frame comprising a first rigid elongated member; a second rigid elongated member mounted perpendicularly on the first rigid elongated member; first and second pads attached perpendicularly to the first rigid elongated member; a third pad attached perpendicularly to the second rigid elongated member; and means for varying the position of the first, second, and third pads, and for fixating said position as required, for effecting orientation-determining contact of the first, second, and third pads with a patient undergoing hip-replacement surgery; (b) providing a pelvis level including a level disposed in a housing which includes first and second parallel straight-line openings extending therethrough; (c) adjusting the pelvis frame so that the first and second pads rest on the anterior superior iliac spines of the patient undergoing the hip-

replacement surgery; (d) adjusting the pelvis frame so that the third pad rests on the pubic symphysis of the pelvic bone of the patient undergoing the surgery; (e) drilling first and second wires into the anterior superior iliac spine through first and second openings in the first or second pad contacting the anterior superior iliac spine on the side on which the surgery is to be performed; (f) removing the pelvis frame from contact with the patient; (g) turning the patient from back contact to side contact with an operating-room bed; (h) beginning the hip-replacement surgery; (i) at a point during the surgery that the acetabular component of the pelvic bone is to be replaced, sliding the pelvis level over the first and second wires through the first and second holes in the pelvis level; (j) adjusting position of the operating-room bed as required until the pelvis level indicates level position; and (k) replacing the acetabular component of the pelvic bone.

#### **BRIEF DESCRIPTION OF DRAWINGS**

[0007] *Fig. 1A* is a plan view of a pelvis frame for hip-replacement surgery, made in accordance with the principles of the present invention.

[0008] *FIG. 1B* is a front elevation of the pelvis frame shown in *FIG. 1A*.

[0009] *FIG. 1C* is a side elevation of the pelvis frame shown in *FIG. 1A*.

[0010] *FIG. 2* is a schematic representation of a portion of the body of a patient undergoing hip-replacement surgery, lying on his/her back, with the pelvis frame of *FIGS. 1A - 1C* resting thereon.

[0011] *FIG. 3A* is an isometric view of a bubble level for hip-replacement surgery, made in accordance with the principles of the present invention.

[0012] *FIG. 3B* is a plan view of the bubble level shown in *FIG. 3A*.

[0013] *FIG. 3C* is a side view of the bubble level shown in *FIGS. 3A* and *3B*.

[0014] *FIG. 4A* is an isometric view of a ball level for hip-replacement surgery, made in accordance with the principles of the present invention.

[0015] *FIG. 4B* is a plan view of the ball level shown in *FIG. 4A*.

[0016] *FIG. 4C* is a side view of the ball level shown in *FIGS. 4A* and *4B*.

[0017] *FIG. 5A* is a schematic representation of the side of the body of a patient lying on his/her side, with two wires in the pelvis, and the bubble or ball level inserted over the wires.

[0018] *FIG. 5B* is a schematic representation of the front of the body of a patient lying on his/her side, with two wires in the pelvis, and the bubble or ball level inserted over the wires.

#### **DETAILED DESCRIPTION**

[0019] More specifically, reference is made to *FIGS. 1A–1C*, in which is shown a pelvis frame for hip-replacement surgery, made in accordance with the principles of the present invention, and generally designated by the numeral 2.

[0020] The pelvis frame 2 comprises a first rigid elongated member 4; a second rigid elongated member 6 mounted on the first rigid elongated member 4 in a perpendicular relationship thereto; first and second pads 8*a* and 8*b* attached to the first rigid elongated member 4 in a perpendicular configuration; a third pad 10 attached to the second rigid elongated member 6 in a perpendicular configuration; and screw-down knobs 12*a*, 12*b*, and 12*c*. The screw-down knobs 12*a*, 12*b*, and 12*c* provide the means for varying the position of the first, second, and third pads 8*a*, 8*b*, and 10, and for fixating said position as required, for effecting orientation-determining contact of the first, second, and third pads 8*a*, 8*b*, and 10 with the pelvic bone of a patient

undergoing hip-replacement surgery.

[0021] As seen best in *FIG. 1B* and *FIG. 1C*, the first, second, and third pads *8a*, *8b*, and *10* are contoured to conform to portions of the pelvic bone which said pads contact. More specifically, pads *8a* and *8b* are cylindrical, with a contact surface *8c* which is concave. By concave is meant that the surface *8c* is concave as viewed in *FIG. 1B*. The third pad *10* is cylindrical, with a contact surface *10a* which is saddle-shaped. By saddle-shaped is meant that the surface *10a* is saddle-shaped as viewed in *FIG. 1C*. The first and second pads *8a* and *8b* include guide openings *8d* for insertion of wires used to determine the orientation of the patient undergoing surgery. The width of the guide openings *8d* is preferably about two millimeters. Disposition of the guide openings *8d* is defined in *FIG. 1A*. Intersection of a line *8e* drawn perpendicular to the first rigid elongated member *4* with a line *8f* drawn between and connecting the guide openings *8d* to one another defines an angle *8g* of from about twenty degrees to about thirty degrees. Preferably, the angle *8g* has a magnitude of from about twenty-four degrees to about twenty-six degrees. Most preferably, the magnitude of the angle *8g* is about twenty-five degrees.

[0022] Reference is now made to *FIG. 2*, in which is represented a

portion of the anatomy of a patient undergoing hip-replacement surgery, with the pelvis frame 2 resting on the patient's abdomen. More specifically, the first and second pads 8a and 8b contact the patient's anterior superior iliac spines 14, while the third pad 10 rests on the pubic symphysis 16 of the patient's pelvic bone 17.

[0023] Reference is now made to *FIGS. 3A - 3C*, in which is shown a bubble level for hip-replacement surgery, made in accordance with the principles of the present invention, and generally designated by the numeral 18. The bubble level 18 comprises a housing 20 which includes first and second parallel straight-line openings 20a and 20b extending therethrough, for insertion therein of first and second wires 22a and 22b. The wires 22a and 22b are used to effect temporary connection of the housing 20 to the pelvic bone 17 of the patient undergoing the hip-replacement surgery. The bubble level 18 further comprises a liquid 24 including a bubble 24a, disposed under a convex transparent cover 26. By convex is meant convex as viewed in *FIGS. 3A - 3C*.

[0024] Reference is now made to *FIGS. 4A - 4C*, in which is shown a ball level for hip-replacement surgery, made in accordance with the principles of the present invention, and generally designated by the numeral 28. The ball level 28



comprises a housing 30 which includes first and second parallel straight-line openings 30a and 30b extending therethrough, for insertion therein of the first and second wires 22a and 22b. As for the bubble level 18, the wires 22a and 22b are used for the temporary connection of the housing 30 to the pelvic bone 17 of the patient undergoing the surgery. The ball level 28 further comprises a ball 33 disposed on a concave surface 35 between a transparent cover 36 and the concave surface 35. By concave is meant concave as viewed in *FIGS. 4A - 4C*. The ball level 28 is beneficially made of materials that can withstand steam sterilization. Thus, the ball 33 and the housing 30 are preferably made of metal, polytetrafluoroethylene, a heat-resistant plastic, a ceramic, or other heat-resistant material. The transparent cover 36 is preferably made of Pyrex<sup>®</sup> glass or any other transparent heat-resistant material.

[0025] For a description of the surgical method of the present invention, reference is again made to *FIGS. 2 - 5B*.

[0026] As shown in *FIG. 2*, after anesthesia has been administered to the patient, the pelvis frame 2 is placed on the front of the patient's lower abdominal area, with the patient lying on his or her back on an operating room bed 19. The pelvis frame 2 is adjusted so that the first and second

pads *8a* and *8b* rest on the anterior superior iliac spines *14*, and the third pad *10* rests on the public symphysis *16* of the patient's pelvic bone *17*. On the side that the hip replacement is to be performed, the two wires *22a* and *22b* are drilled into the anterior superior iliac spine *14* through the openings *8d* in the first or second pad *8a* or *8b*. The pelvis frame *2* is then removed, leaving the wires *22a* and *22b* in the pelvis.

[0027] As shown in *FIG. 5A and 5B*, the patient is then turned side-ways on the operating room bed *19*, and the hip surgery is begun. *FIG. 5A* depicts a patient having a right hip surgery. The wires *22a* and *22b* are perpendicular to the coronal plane *15* of the pelvis. At the point during the surgery that the acetabular component *17a* of the pelvic bone *17* is to be replaced, the pelvis level *18* (*FIGS. 3A – 3C*) or *28* (*FIGS. 4A – 4C*) is slid over the wires *22a* and *22b* through the openings *20a* and *20b* (*FIGS. 3A – 3C*) or *30a* and *30b* (*FIGS. 4A – 4C*) in the housing *20* (*FIGS. 3A – 3C*) or *30* (*FIGS. 4A – 4C*). The operating room bed *19* is then adjusted with its built-in controls until the bubble *24a* (*FIGS. 3A – 3C*) or the ball *33* (*FIGS. 4A – 4C*) is centered, indicating that the pelvis is perpendicular to the floor of the operating room, and providing the surgeon with the necessary information to

insert the acetabular component *17a* at the correct angle. Crosshairs *27a* (FIGS. 3A and 3B) or *37a* (FIGS. 4A and 4B) on the pelvis level *18* (FIGS. 3A–3C) or *28* (FIGS. 4A–4C) are parallel to the coronal plane *15* of the pelvis as depicted in FIG. 5A. The crosshairs *27a* (FIGS 3A and 3B) and *37a* (FIGS. 4A and 4B) therefore provide additional information about pelvic position which is not accounted for by centering the bubble or the ball. At the end of the operation, the alignment wires *22a* and *22b* are removed from the patient's pelvis.

[0028] While certain embodiments and details have been described to illustrate the present invention, it will be apparent to those skilled in the art that many modifications are possible and can be made without departing from the spirit, basic principles, and scope of the invention.